07_sentiment_modeling_dataset

December 2, 2025

1 Sentiment Modeling Dataset

Build a single monthly dataset that combines PP prices/returns, PP residuals, and OPEC sentiment indices, then run a quick EDA to understand sentiment vs PP before modeling. All inputs are precomputed artifacts; no external APIs are used.

[1]:

```
from pathlib import Path
import sys
import warnings

import pandas as pd
import matplotlib.pyplot as plt
from IPython.display import display

NOTEBOOK_DIR = Path(__file__).resolve().parent if "__file__" in globals() else␣
 ↪Path.cwd()
ROOT = NOTEBOOK_DIR.parent
if str(ROOT) not in sys.path:
    sys.path.append(str(ROOT))

from src.model_dataset_utils import (
    build_modeling_dataset,
    summarize_modeling_dataset,
    plot_pp_vs_opec_index,
    plot_residual_vs_index_scatter,
    plot_leadlag_sentiment_vs_residual,
)

DATA = ROOT / "data"
ART = ROOT / "artifacts"
PLOTS = ROOT / "plots"
for path in (ART, PLOTS):
    path.mkdir(parents=True, exist_ok=True)

warnings.filterwarnings("ignore")
pd.set_option("display.max_columns", 40)
print(f"ROOT set to {ROOT}")
```

```
ROOT set to c:\PythonProjects\LLM-polypropylene
```

[2]:

```python
df_model = pd.DataFrame()
meta = {}

try:
    df_model, meta = build_modeling_dataset(ROOT)
except Exception as exc:
    print(f"Failed to build modeling dataset: {exc}")

if df_model.empty:
    print("Modeling dataset is empty; downstream steps will be skipped.")
else:
    print(f"Shape: {df_model.shape}")
    print(f"Date range: {df_model.index.min().date()} to {df_model.index.max().
  ↪date()}")
    print(f"Columns: {list(df_model.columns)}")
    display(df_model.head())
    display(df_model.tail())
    print("Metadata:", meta)
```

```
Loaded monthly prices from c:\PythonProjects\LLM-
polypropylene\artifacts\merged_monthly_prices.csv, columns: ['PP', 'PGP',
'CRUDE'], coverage: 2015-01-31 to 2025-03-31
Loaded monthly returns from c:\PythonProjects\LLM-
polypropylene\artifacts\merged_monthly_returns.csv, columns: ['PP', 'PGP',
'CRUDE'], coverage: 2015-02-28 to 2025-03-31
Loaded residuals from c:\PythonProjects\LLM-
polypropylene\artifacts\pp_idiosyncratic_residual.csv, rows: 119, coverage:
2015-05-31 to 2025-03-31
Loaded OPEC monthly index from c:\PythonProjects\LLM-
polypropylene\artifacts\opec_sentiment_monthly_index.csv, columns:
['score_demand', 'score_overall', 'score_price_outlook', 'score_supply',
'index_demand', 'index_overall', 'index_price_outlook', 'index_supply',
'index_hybrid']
Loaded OPEC section scores from c:\PythonProjects\LLM-
polypropylene\artifacts\opec_sentiment_monthly_section_scores.csv
OPEC index coverage: 2019-01-31 to 2025-11-30
Modeling dataset shape: (130, 16)
Coverage: 2015-02-28 to 2025-11-30
Shape: (130, 16)
Date range: 2015-02-28 to 2025-11-30
Columns: ['PP', 'PGP', 'CRUDE', 'ret_PP', 'ret_PGP', 'ret_CRUDE', 'resid_PP',
'score_demand', 'score_overall', 'score_price_outlook', 'score_supply',
'index_demand', 'index_overall', 'index_price_outlook', 'index_supply',
'index_hybrid']
```

```
                PP      PGP       CRUDE     ret_PP    ret_PGP   ret_CRUDE   \
2015-02-28  8748.0  8748.0  50.724736  0.054348  0.054348   0.069364
2015-03-31  8829.4  8829.4  47.854091  0.009262  0.009262  -0.058257
2015-04-30  9348.0  9348.0  54.628096  0.057075  0.057075   0.132392
2015-05-31  9142.0  9142.0  59.372000 -0.022283 -0.022283   0.083274
2015-06-30  8786.0  8786.0  59.828637 -0.039720 -0.039720   0.007662

             resid_PP  score_demand  score_overall  score_price_outlook  \
2015-02-28       NaN           NaN            NaN                  NaN
2015-03-31       NaN           NaN            NaN                  NaN
2015-04-30       NaN           NaN            NaN                  NaN
2015-05-31 -0.025787           NaN            NaN                  NaN
2015-06-30 -0.033245           NaN            NaN                  NaN

            score_supply  index_demand  index_overall  index_price_outlook  \
2015-02-28           NaN           NaN            NaN                  NaN
2015-03-31           NaN           NaN            NaN                  NaN
2015-04-30           NaN           NaN            NaN                  NaN
2015-05-31           NaN           NaN            NaN                  NaN
2015-06-30           NaN           NaN            NaN                  NaN

            index_supply  index_hybrid
2015-02-28           NaN           NaN
2015-03-31           NaN           NaN
2015-04-30           NaN           NaN
2015-05-31           NaN           NaN
2015-06-30           NaN           NaN
            PP  PGP  CRUDE  ret_PP  ret_PGP  ret_CRUDE  resid_PP  \
2025-07-31 NaN  NaN    NaN     NaN      NaN        NaN       NaN
2025-08-31 NaN  NaN    NaN     NaN      NaN        NaN       NaN
2025-09-30 NaN  NaN    NaN     NaN      NaN        NaN       NaN
2025-10-31 NaN  NaN    NaN     NaN      NaN        NaN       NaN
2025-11-30 NaN  NaN    NaN     NaN      NaN        NaN       NaN

            score_demand  score_overall  score_price_outlook  score_supply  \
2025-07-31     -0.465910            0.7             0.730664     -0.382759
2025-08-31     -0.439590            0.7             0.341918     -0.376988
2025-09-30     -0.592581            0.3             0.675067     -0.389453
2025-10-31     -0.494205            0.4             0.173203     -0.468063
2025-11-30     -0.406237            0.3            -0.027499     -0.509039

            index_demand  index_overall  index_price_outlook  index_supply  \
2025-07-31    -13.950573            8.3            33.377305      5.704018
2025-08-31    -14.390164            9.0            33.719222      5.327030
2025-09-30    -14.982745            9.3            34.394289      4.937577
2025-10-31    -15.476949            9.7            34.567492      4.469514
2025-11-30    -15.883186           10.0            34.539993      3.960475
```

```
            index_hybrid
2025-07-31      8.357687
2025-08-31      8.414022
2025-09-30      8.412280
2025-10-31      8.315014
2025-11-30      8.154320
```

```
Metadata: {'start_date': '2015-02-28', 'end_date': '2025-11-30', 'n_months':
'130', 'columns': 'PP, PGP, CRUDE, ret_PP, ret_PGP, ret_CRUDE, resid_PP,
score_demand, score_overall, score_price_outlook, score_supply, index_demand,
index_overall, index_price_outlook, index_supply, index_hybrid'}
```

[3]:

```python
if df_model.empty:
    print("Skipping dataset export; nothing to save.")
else:
    out_path = ART / "modeling_dataset_monthly.csv"
    df_model.reset_index().rename(columns={"index": "date"}).to_csv(out_path, index=False)
    print(f"Saved modeling dataset -> {out_path}")
```

```
Saved modeling dataset -> c:\PythonProjects\LLM-polypropylene\artifacts\modeling_dataset_monthly.csv
```

[4]:

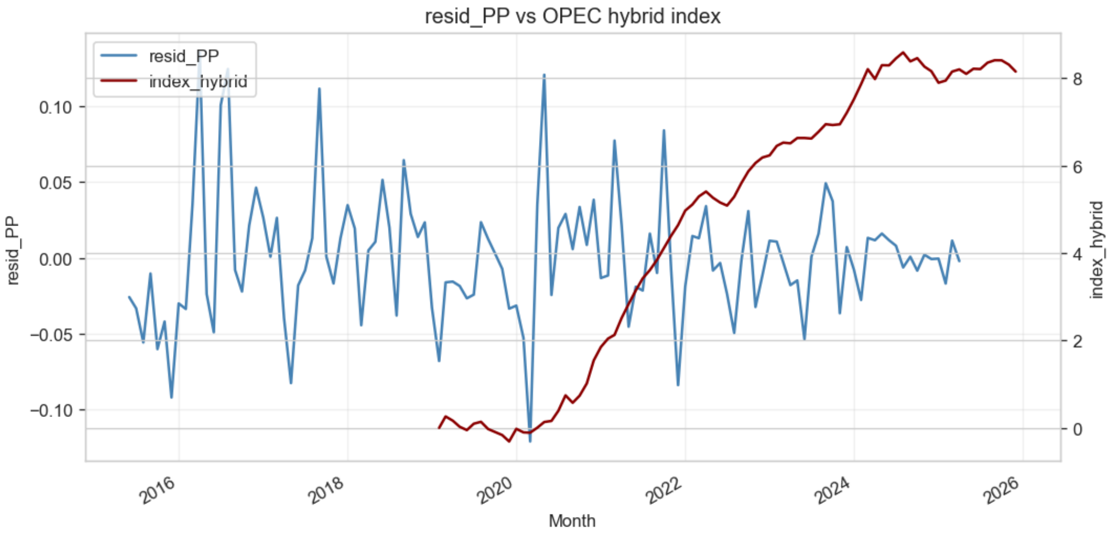
```python
summaries = summarize_modeling_dataset(df_model) if not df_model.empty else {}

if not summaries or df_model.empty:
    print('No summaries to display.')
else:
    desc = summaries.get('describe')
    miss = summaries.get('missing')
    corr = summaries.get('corr')

    print('Descriptive stats:')
    display(desc)

    print("\nMissing values:")
    display(miss)

    if corr is not None and not corr.empty:
        print("\nCorrelation matrix:")
        display(corr)

    # Save summaries
    desc_path = ART / 'modeling_dataset_describe.csv'
    miss_path = ART / 'modeling_dataset_missing.csv'
    corr_path = ART / 'modeling_dataset_corr.csv'
    desc.to_csv(desc_path)
    miss.to_csv(miss_path)
    if corr is not None and not corr.empty:
        corr.to_csv(corr_path)
    print(f'Saved summaries to {ART}')
```

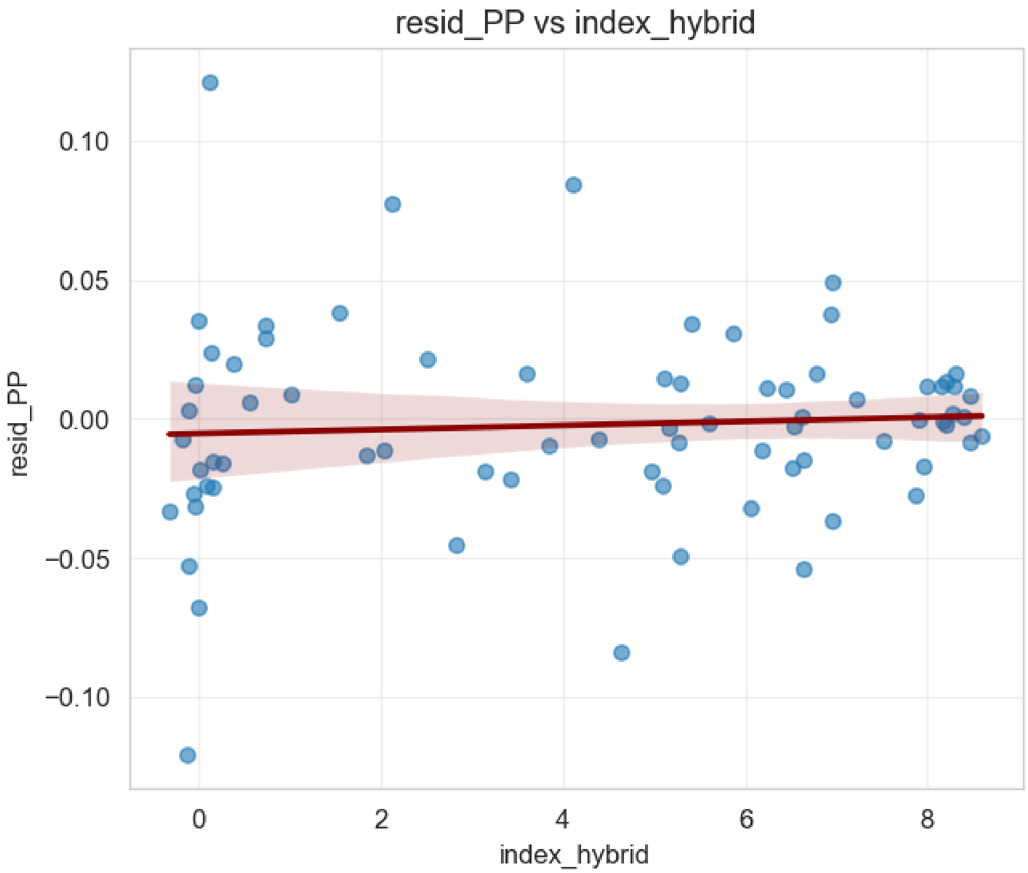
```
Descriptive stats:

                     count          mean         std          min  \
PP                   122.0  8.190967e+03  855.627555  6043.600000
PGP                  122.0  8.190967e+03  855.627555  6043.600000
CRUDE                122.0  6.232619e+01   17.816844    16.699048
ret_PP               122.0 -1.052335e-03    0.042444    -0.131583
ret_PGP              122.0 -1.052335e-03    0.042444    -0.131583
ret_CRUDE            122.0  2.963678e-03    0.120098    -0.600585
resid_PP             119.0  1.012262e-16    0.041258    -0.121069
score_demand          82.0 -1.896560e-01    0.306369    -0.592581
score_overall         81.0  1.234568e-01    0.560641    -0.900000
score_price_outlook   82.0  4.249247e-01    0.314560    -0.098708
score_supply          82.0  4.798564e-02    0.345477    -0.509039
index_demand          83.0 -4.035231e+00    5.850803   -15.883186
index_overall         83.0 -3.144578e-01    5.959500   -10.800000
index_price_outlook   83.0  1.613468e+01   10.261895     0.000000
index_supply          83.0  6.833947e+00    3.717035     0.000000
index_hybrid          83.0  4.654735e+00    3.228771    -0.310274

                             25%          50%          75%           max
PP                   7566.737500  8186.000000  8800.062500  10339.250000
PGP                  7566.737500  8186.000000  8800.062500  10339.250000
CRUDE                  49.058365    60.347045    73.738866    114.339048
ret_PP                 -0.023175    -0.001969     0.020649      0.149596
ret_PGP                -0.023175    -0.001969     0.020649      0.149596
ret_CRUDE              -0.053332     0.019625     0.056092      0.535517
resid_PP               -0.023786    -0.001608     0.017806      0.135678
score_demand           -0.436936    -0.216037     0.022726      0.532321
score_overall          -0.400000     0.400000     0.600000      0.800000
score_price_outlook     0.166677     0.322499     0.748457      0.980334
score_supply           -0.345003     0.080297     0.162933      0.658455
index_demand           -9.191848    -2.458879     0.645331      3.228908
index_overall          -5.350000    -0.700000     5.300000     10.000000
index_price_outlook     6.975030    14.961675    24.227515     34.567492
index_supply            3.930363     7.593114    10.350194     12.371179
index_hybrid            0.881179     5.296614     7.923849      8.593474

Missing values:

                     missing_count
PP                               8
PGP                              8
CRUDE                            8
```

```
ret_PP                       8
ret_PGP                      8
ret_CRUDE                    8
resid_PP                    11
score_demand                48
score_overall               49
score_price_outlook         48
score_supply                48
index_demand                47
index_overall               47
index_price_outlook         47
index_supply                47
index_hybrid                47


Correlation matrix:
                       ret_PP      resid_PP  index_hybrid  index_demand  \
ret_PP               1.000000  9.749861e-01      0.058252      0.031054
resid_PP             0.974986  1.000000e+00      0.066762      0.007338
index_hybrid         0.058252  6.676164e-02      1.000000     -0.868254
index_demand         0.031054  7.338081e-03     -0.868254      1.000000
index_supply         0.097761  9.714554e-02      0.811000     -0.459749
index_price_outlook  0.073303  8.668097e-02      0.953841     -0.941189
ret_CRUDE            0.209743 -1.958379e-16     -0.023961      0.099182
ret_PGP              1.000000  9.749861e-01      0.058252      0.031054

                     index_supply  index_price_outlook     ret_CRUDE   ret_PGP
ret_PP                   0.097761             0.073303  2.097435e-01  1.000000
resid_PP                 0.097146             0.086681 -1.958379e-16  0.974986
index_hybrid             0.811000             0.953841 -2.396133e-02  0.058252
index_demand            -0.459749            -0.941189  9.918233e-02  0.031054
index_supply             1.000000             0.627322  1.533391e-02  0.097761
index_price_outlook      0.627322             1.000000 -4.561815e-02  0.073303
ret_CRUDE                0.015334            -0.045618  1.000000e+00  0.209743
ret_PGP                  0.097761             0.073303  2.097435e-01  1.000000
Saved summaries to c:\PythonProjects\LLM-polypropylene\artifacts
```

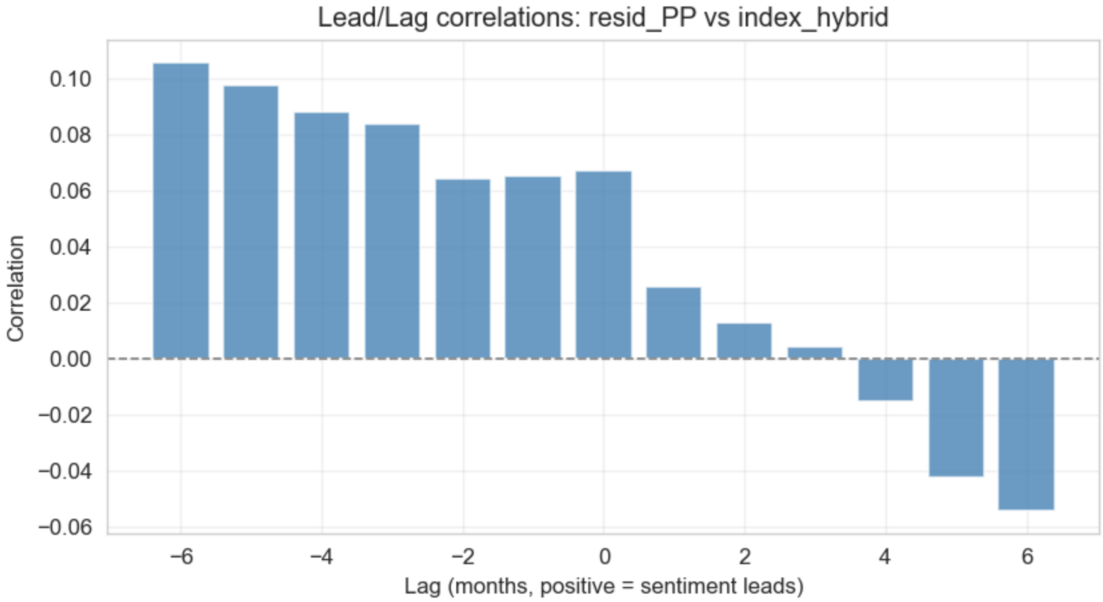
[5]:

```python
if df_model.empty:
    print("Skipping plots; dataset is empty.")
else:
    # Time-series: PP residuals/returns vs hybrid index
    try:
        fig_ts = plot_pp_vs_opec_index(df_model)
        path_ts = PLOTS / "model_pp_vs_opec_index_timeseries.png"
        fig_ts.savefig(path_ts, dpi=150, bbox_inches="tight")
        display(fig_ts)
    except Exception as exc:
        print(f"Time-series plot failed: {exc}")
    finally:
        plt.close('all')

    # Scatter residuals vs index
    try:
        fig_scatter = plot_residual_vs_index_scatter(df_model)
        path_scatter = PLOTS / "model_pp_residual_vs_opec_index_scatter.png"
        fig_scatter.savefig(path_scatter, dpi=150, bbox_inches="tight")
        display(fig_scatter)
    except Exception as exc:
        print(f"Scatter plot failed: {exc}")
    finally:
        plt.close('all')

    # Lead/lag correlations
    try:
        fig_leadlag = plot_leadlag_sentiment_vs_residual(df_model, max_lag=6)
        path_leadlag = PLOTS / "model_leadlag_residual_index_hybrid.png"
        fig_leadlag.savefig(path_leadlag, dpi=150, bbox_inches="tight")
        display(fig_leadlag)
    except Exception as exc:
        print(f"Lead/lag plot failed: {exc}")
    finally:
        plt.close('all')
```





resid_PP vs index_hybrid
resid_PP
0.10
0.05
0.00
−0.05
−0.10
0
2
4
6
8
index_hybrid



Lead/Lag correlations: resid_PP vs index_hybrid
Correlation
0.10
0.08
0.06
0.04
0.02
0.00
−0.02
−0.04
−0.06
−6
−4
−2
0
2
4
6
Lag (months, positive = sentiment leads)

[6]:

```
if df_model.empty:
    print("No dataset to interpret.")
else:
    start = df_model.index.min().date()
    end = df_model.index.max().date()
    print(f"Modeling dataset spans {start} to {end} with {len(df_model)} months.
  ↪")
    print("Use these merged features (PP, returns, residuals, OPEC indices) in␣
  ↪the next notebook for sentiment-augmented forecasting.")
```

```
Modeling dataset spans 2015-02-28 to 2025-11-30 with 130 months.
Use these merged features (PP, returns, residuals, OPEC indices) in the next
notebook for sentiment-augmented forecasting.
```